The Blind Have "Optical Illusions

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THE BLIND HAVE "OPTICAL ILLUSIONS"

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It has been known for some time that a fruitful approach to the problem of perception is through studies of illusions. This is due, of course, to the fact that discovery of anything that prevents a group of these misperceptions from becoming true percepts reveals a necessary factor in efficient perceiving in that field.

The justification of this study of the reactions of the blind to illusion patterns is that their active touch behavior in perceiving is more objective and can be observed in greater detail.

Twenty-eight totally blind persons were found in the Louisiana School for the blind and in the University who could be available for this research, and one who, on rare occasions, was able to see uncertainly one edge of an object when there was a strong light on the opposite side of it. All but three had been blind from birth. One of these had normal sight one year, another two years, and a very bright eleven-year-old girl was deprived of her sight at nine, when she was operated on for a brain tumor.

The ages of nine of these blind subjects ranged from seven to eleven years, eight of them from twelve to fifteen years, six from sixteen to nineteen years, and five between twenty and twenty-six years of age.

Twenty-eight persons, with corresponding numbers in these four age levels, were selected for the visual group from the practice school, the colleges, and the graduate school of Louisiana State University.

The individuals were matched in the relative quality of their school work, but not in intelligence quotients, because the tests for the blind are thus far insufficiently standardized.

Both were experimental groups for comparison of their behavior rather than an experimental and a control group except in so far as this end was served by subsequent presentation of the same patterns to the sight of the visuals.

The graduate student was the only observer who had any knowledge of illusions.

Six well-known patterns of unlike types were used, the Müller-Lyer, the horizontal-vertical, the Poggendorff, the two equal circles within an acute angle, the Zöllner, and the two segments of a ring. These figures were mounted in relief on veneer-ply boards. The linear patterns were made of wire twelve-hundredths of an inch in diameter and the surfaces were cut out of thick sheet aluminum of similar thickness.

The patterns were large enough to require active exploration, a much more usual way of sense-perceiving objects and spaces than passive reception of pressure stmiulation. The pressure of small patterns on the hand was the method employed by Révész[1]. His blind and visuals got a wide variety of illusions.

In order to obviate suggestion, which leads to expectation and preparatory set and were doubtless factors in the experiments of Révész, I made each pattern in several sizes, with the primary dimensions equal and unequal. These were presented in unpredictable order.

The experimenter sat at one end and the observer at the other of a table. A canvas hood helped to conceal from sight the stimuli not in use and the one being examined by the subject. The leaves of the table in vertical position, the hood and the screen were used with the fifty-six subjects, blind and seeing. Several very active children looked under the hood before directions could be given. This justified the use of a one-way screen in addition to the hood.

After a stimulus board had been slid beyond the screen to cleets that held it firmly within equally easy reach of either of the reagents' hands, he was told to explore it thoroughly with his preferred hand until he was sure of the decision that he was required to make.

As was expected, perception through active touch exhibited the process of perceiving in a much more obvious, objective form than perception through sight and is freer from disturbing factors in the technique.

Every blind and visual reagent seemed to find the short lines of the Zöllner illusion serious obstacles to progress back and forth on the long lines from the beginning of inspection to the slowly-reached conclusion. The lines seemed longer than they were.

After the first rapid survey of the horizontal-vertical pattern, the fingers of the observers who experienced the illusion went from end to end of the horizontal line, but strangely failed to go to the top of the vertical line. The illusion was usually greater when the vertical line extended upwards from the horizontal line than when it extended downwards, and was more often and more promptly reported.

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[1] Révész, G., System der optischen und haptischen Raumtäuschungen. *Zeits. f. Psychol.*, 1934, 131, 296–375.

Inspection of the Poggendorff pattern consisted of the following of the line to the vertical column, indications of confusion, then ascending and descending along its two edges several times, fumbling for the other line, and slowly overcoming the difficulties in finding the other portion of the line. The decision was not rendered by those who got this illusion until the fingers succeeded in slowly following what seems to be an imaginary line across the column from the entrance of the line to its exit.

On the Müller-Lyer pattern the last part of the systematic procedure was a to-and-fro motion. The fingers never went beyond the ends of the line with feather-like trimmings. But they almost always stopped short of the ends of the line with arrowheads, and when they did go, to the ends, they moved as mine would if I were interested in the angular spaces between one line of the arrowhead and the main line.

Comparison of the two equal circles was made most consistently by tracing only part of each circumference, then of the spaces between each circle and the lines of the angle. The widths of the ring segments were quickly declared by all to be equal after sliding the hand across the one and the other. Comparison of their lengths was much slower, and judgment was very often made just after the handling of the sides of the two figures that were closest to each other. There was a tendency, after a corner or two had been turned in a ring segment, to move erringly along the lines as though they were expected to be straight like the sides of a rectangle. Usually a finger could not remain on a curved line without the help of the thumb on its opposite side. In these reactions to the sectors of a ring, decisions were immediate when the fingers found the two unequal adjacent lines. In the vertical-horizontal figure pains were not taken to go to the top of the vertical one, but only far enough to detect its apparent greater length.

A standard pattern either gave an observer an illusion every time, or nearly every time, that he was given an opportunity for his hand to explore it or else his responses were totally irregular. There was in no case any discoverable inclination towards correct perception instead of illusory perception.

Consistent, repeated responses showed that the Müller-Lyer illusion was experienced by 24 blind and by 2 visuals; the Poggendorff by 22 blind and 4 visuals; the vertical-horizontal by 22 blind and 3 visuals; the circles in the angle by 12 blind and no visuals; the Zöllner by 10 blind and no visuals; and the ring segments by 7 blind and 2 visuals.

In the blind group, the dull eight-year-old girl gave totally inconsistent reports and the very dull seventeen-year-old boy responded definitely to the Müller-Lyer illusion, but to no other. In general, in the blind group and the seeing group the brighter the observers the more illusions they had. The total percent of illusion reactions by the blind children who were seven to nine years old was 57; by those who were eleven, 72; by twelve to fourteen-year-old youths, 55; by fifteen-year-olds, 57; sixteens, 62 and nineteens, 72. The two blind college students and one graduate experienced 72 percent. The eleven-year-old children were on a par with the blind who were nineteen and older, partly because of the bright girl who had normal sight until she was nine years old.

All of the visuals, except the two dullest, when finally permitted to use sight, experienced illusions with every standard pattern. Striking differences were found in those who had many illusions and those who had few. The reagents who had many waited to hear all instructions, and complied with them more understandingly. There was much more system in their procedure. They searched the entire board first, then they surveyed the total relief layout. This was followed by somewhat more careful inspection of one figure, then of the other, and finally of the parts to be compared. Decisions were quite often rendered before this entire process had been completed, and at other times the latter steps were rehearsed. There were, in contrast with this, all degrees of lack of system.

Conclusions

The only observable difference in the behavior of the seeing and the lifelong blind, under these similar conditions, was in the number of the illusions. Resemblances were many. Here we have evidence enough that observation of the behavior of the blind while perceiving tactokinaesthically under properly controlled conditions is a safe objective procedure in the analysis of human perceiving.

The large number of illusions experienced by the visuals when the stimuli were presented to their sight shows that their inferiority to the blind in active touch perception was due to lack of practice in perceiving.

The older the person, whether blind or a visual, the more illusions he experienced, and the better his school work, the more illusions. These facts indicate that those who are equipped to perceive best are also the most likely to have these misperceptions.

The greater the amount of system in the manner of proceeding in those who were most able to perceive, among both visuals and blind, show that perceiving correctly under the most usual circumstances is an habituated process, and that these habit patterns lead to incorrect perceiving under some of the less usual circumstances. Moreover, the decreasing degrees of success with the less and less capable and less and less systematic ways of going about the perceiving of space relations support the same conclusions. These facts and the tendency to move in straight lines after passing an angle in the ring segments are samples of the evidence that perceptual ability consists, in part, of habits, and that under unusual circumstances these habits lead to misperceptions.

Whatever hinders movement slows the process of perceiving and distorts the patterns or often prevents perception. If the surprise of an interruption is given time to wear off, perception becomes more possible.

Generalizations

The blind and the seeing perceive very much alike even though their sense departments are different. This justifies the study of perception through the perceptual behavior of the blind.

Habituated systematic procedure in a sensory mode is a requisite to efficient perception.

Perception is necessarily a much more rapid process than apperception, thorough observation. Therefore it relies on mere clues, as has been shown by the results of this research.

The importance of a technique in perception experiments that avoids misleading suggestions lies in the fact that these clues also are mere suggestions that lead aright in most cases.

When these clues are accompaniments of usual shapes and dimensions true perceptions result; but when unusual shapes or sizes possess the clues that are found in usual shapes or sizes, perception habits lead to misperceptions.

Adjacent sides of two figures are shown in this research to serve as simple phases by which their relative sizes are perceived or misperceived. On the other hand, there are evidences that areas, hinted at by combinations of lines, participate in the perception or misperception of the lengths of lines and also of the sizes of other figures. The whole layout seems thus to have a part in the perception of each portion of it.

Perhaps this is the explanation also of the fact that efficiency of perception was greater the more the observer was inclined to explore the whole layout first, then to handle the largest units into which it was readily separated, and to proceed to find details.

The sources of these well established habits of perceiving are partly disclosed in the comparative lack of efficiency of the seeing subjects in active touch perception, and in the greater difficulty in perceiving the more the movements are obstructed, and in the fact that the more capable and the older perceived best. They can therefore be more than hypothetically accounted for in the following ways:

(*a*) Efficiency in perceiving is the result of long intelligent habit-forming experience.

(*b*) Oculo-motor theories cannot explain the perceptions and mis-perceptions of the lifelong blind and they are not sufficient to account for all these phenomena in observers who see. If vertical lines seem longer than their horizontal counterparts because of some ocular limitation or other in the narrower vertical range, why do persons who have never been able to see have this type of illusion?

(*c*) Whether or not a person's space world has its first foundations laid by movements through environment, as suggested by these results and by observations of infants, much of our knowledge of distances is gained by traversing them.

(*d*) Enough more energy is consumed in climbing hills, stairways, ladders, and trees than by walking horizontal distances, that are equal in terms of the meter stick, to give exaggerated impressions of heights over other dimensions.

(*c*) Hindrances to travelling and other movements are common, and require enough more effort to make all broken distances appear to be longer than unbroken distances that are equal in terms of feet and inches.

Perceiving of areas and distances seems from this research to be dependent on habituated clues and past experiences of energy consumption. But of course these conclusions are far from final.

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